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ABSTRACT

The report suggests that, in the process of acquiring hardware and software for students to use, teachers often have been overlooked. To use new technologies well, teachers need more than just access to these resources. They need opportunities to discover what the technologies can do, learn how to operate them, and experiment with ways to best apply them in their classrooms. This report seeks to underscore the connection between teachers and the implementation of technology in schools. Several key findings are examined in this summary: national statistics on computer equipment levels in schools; teacher computer use data; teacher attitudes toward technology; curriculum integration; teacher technology education; federal teacher development programs; and the educational level of focus of governmental support of technology in schools. A discussion on policy options and governmental role includes: "Federal Leadership: Legitimizing, Funding, and Targeting Technology"; "Research, Development, and Dissemination"; "Educating New Teachers, Professional Development, and Teacher Support"; and "School Access to the Emerging Telecommunications Infrastructure." (MAS)

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OFFICE OF TECHNOLOGY ASSESSMENT U.S. CONGRESS APRIL 1995

OTA REPORT SUMMARY

ED 386 154

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Teachers & technology: *making the connection*

Technology is a fact of American life. Computers, video, television, telephones, radio, and telecommunications networks exert an incalculable influence on how we live, work, and play—an influence likely to expand as hardware and software become more powerful and affordable.

New technologies are already essential tools for doing business and are quickly becoming a primary means for people to acquire information. Recognizing their responsibility to prepare students to live and work in this technological society, the nation's schools have often enlisted as resources the most relevant technological innovations available, whether television or telecommunications, calculators or computers. OTA estimates that every year in the past decade, schools have added between 300,000 and 400,000 computers to their inventories. Total public K-12 instructional technology expenditures for 1993 were estimated at $2.13 billion.

Teachers & Technology: Making the Connection, a newly released report from the congressional Office of Technology Assessment, suggests that, in the process of acquiring hardware and software for students to use, teachers—perhaps the most valuable part of the education equation—often have been overlooked.

Given the nation's interest in improving education for students, the lack of attention to teachers and technologies is ironic, for at the center of effective use of instructional technologies by students are those who oversee the daily activities of the classroom—the teachers. To use new technologies well, teachers need more than just access to these resources, they also need opportunities to discover what the technologies can do, to learn how to operate them, and to experiment with ways to best apply them in their classrooms.

There are 2.8 million teachers in K-12 public and private schools today, and an estimated 3.3 million teachers will be needed in schools by 2003. Yet, the implications of how technology can improve the preparation of new teachers or enhance the continuing professional development of those already in the field, are rarely considered. When teachers' needs are discussed, the focus is often on providing short-term, one-shot training to familiarize teachers with a specific application or encourage general computer

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Key Findings

ANDREW M. LEVINE, 1994

literacy. Seldom have policy discussions or initiatives centered on the relationship between technology and the teacher's role. Seldom have they articulated a vision of how technology can empower teachers to carry out all parts of their jobs—not only classroom instruction, but also administrative tasks, communication with parents, and continuing professional development.

Making the connection between teachers and technology could be one of the most important steps the nation can take to make the most of past and continuing investments in educational technology. Helping teachers effectively incorporate technology into the teaching and learning process may not only help students become competent technology users, but may also help them become more accomplished learners overall, with skills necessary for the information age.

OTA conducted this study at the request of the Senate Committee on Labor and Human Resources, with endorsement by the House Committee on Education and Labor (now the House Committee on Economic and Educational Opportunities) and by a member of the Senate Appropriations Committee. This report seeks to underscore the connection between teachers and the implementation of technology in schools.

Key Findings

Some key findings include:

- By spring 1995, schools in the United States will have an estimated 5.8 million computers, or about one computer for every nine students. Almost every school in the country has at least one television and videocassette recorder, and 41 percent of teachers have a TV in their classrooms, but only one teacher in eight has a telephone in class and less than 1 percent have access to voice mail. Classroom access to technologies like CD-ROM and networks is similarly limited. While 75 percent of public schools have access to some kind of telecommunication capabilities (i.e., local- or wide-area networks), and 35 percent of public schools have access to the Internet, only 3 percent of instructional rooms (classrooms, labs, and media centers) are connected to the Internet.
- Despite technologies available in schools, a substantial number of teachers report they do not use computers and other technologies regularly for instruction.

- While technology is not a panacea for all educational ills, today's technologies could be essential tools of the teaching trade. To use these tools well, teachers need visions of the technologies' potential, opportunities to apply them, training and just-in-time support, and time to experiment.
- A majority of teachers report feeling inadequately trained to use technology resources, particularly computer-based technologies. Although many teachers see the value of students learning about computers and other technologies, some are not aware of the resources technology can offer them as professionals in carrying out the many aspects of their jobs.
- Although some schools have made progress in helping teachers to use basic technological tools such as word processing, they still struggle with curriculum integration, which is central if technology is to become a truly effective educational resource. Yet integration is a difficult, time-consuming, and resource-intensive endeavor.
- Technology can be a valuable resource for improving teacher education. It can bring models of the best teaching live from the classroom into the colleges of education, or provide video case studies of teaching styles and approaches. It can forge stronger connections among student teachers, mentor teachers in the field, and university faculty.
- Despite the importance of technology in teacher education, it is not central to the teacher preparation experience in most U.S. colleges of education today. Most new teachers graduate from teacher preparation institutions with limited knowledge of the ways technology can be used in their professional practice.
- The federal government has played a limited role in technology-related teacher development compared with states, universities, and school districts. Even so, past federal programs have piloted innovative educational applications of technology for teachers by providing significant support for professional development (especially among mathematics, science, and special education teachers) and by providing funding for technology-related professional development in school districts that could not have supported it on their own.
- The federal government and the private sector have tended to focus more on technology assistance and funding to K-12 schools than to colleges of education. This approach may address current needs but does not greatly influence teacher preparation or quality over the long term.

TEACHING AND TECHNOLOGY: THE POTENTIAL

Changing teaching and learning
- Teaching abstract concepts, complex systems, problem solving—and basic skills
- Encouraging more independent work, teamwork and collaborative inquiry
- Adapting to student learning styles and special needs
- Expecting more of students and presenting more complex materials
- Adopting roles of "guide on the side" rather than "sage on the stage"
- Lecturing less, with classrooms more student-centered

Assisting with daily tasks
- Preparing lesson plans and materials
- Tracking student progress and keeping records
- Communicating with parents, colleagues, administrators

Enhancing professional development
- Having "just-in-time" training and support via video and telecommunications networks
- Taking formal courses and advanced degrees
- Using online resources for informal educational opportunities

Preparing new teachers
- Viewing models of effective teaching, live or on video
- Analyzing computer and video simulations and cases
- Linking student teachers, mentors, and faculty on electronic networks

SOURCE: Office of Technology Assessment, 1995

Policy Options

CA MODEL TECHNOLOGY SCHOOLS PROJECT, MONTEREY

Policy Options

The array of technology for education is diverse, changing, and flexible. These characteristics enable development of hardware, software, and learning environments that can suit special needs, allow new approaches to teaching and learning, and create excitement in the classroom. This broad and expanding range of educational technologies complements the diversity of the American education system. While the appropriate federal role in education has always been debated, policy decisions regarding technology can allow for variation, change, experimentation, and differing goals, building on the strong traditions of state and local control of education and on emerging examples of public-private partnerships.

If the federal government wants to support the expansion and appropriate use of technologies in K-12 schools and colleges of education, federal policy must go beyond funding. Leadership; a commitment to research, development, and dissemination; an increased emphasis on teachers; and attention focused on issues related to school access to the emerging electronic telecommunications infrastructure are equally critical. The private sector also can play a greater role than it has in the past.

Federal leadership: legitimizing, funding, and targeting technology

Legislation passed by the 103d Congress gave the signal that technology is not only welcome but necessary in schools, and that the federal government has a leadership and coordinating role to play. Programs authorized under the Improving America's Schools Act (P.L. 103-382), especially the major new technology education initiative under Title III of the amendments to the Elementary and Secondary Education Act of 1965 (ESEA) and Title II of the ESEA, the Eisenhower Professional Development Program, could be the centerpieces of a stronger federal role in providing technology-related teacher development, ensuring greater access and equity in the area of technology, and demonstrating and disseminating several promising educational applications.

The Office of Educational Technology—authorized in the 103d Congress and given multiple responsibilities in the Improving America's Schools Act—created a federal focal point for educational technology for the first time. While greater efforts to link teachers and technology were not absolutely required, legislative language and the targeted funds appropriated for fiscal year 1995 provided more explicit congressional directives than ever before for making those connections.

If the current Congress chooses to maintain support for these activities, whether through new appropriations or other sources, it would send a signal that could strongly influence state and local decisions over the next few years.

Regardless of what the Congress decides, the executive branch has opportunity to provide the much-needed spotlight on technology, to coordinate programs, and to take the lead in evaluating and disseminating research results. For example, the na-

tional long-range technology plan under development by the Secretary of Education in accordance with Goals 2000 (P.L. 103-227) offers a powerful policy tool for federal leadership. This plan could provide a long-overdue strategy for the federal role in educational technology across the government, and a framework for an environment of experimentation, evaluation, and sharing of results.

Federal regulatory actions could include establishing priorities or bonus points related to technology in competitive grant programs, issuing policy statements highlighting expenditures for technology and professional development where the law permits, and eliminating unnecessary nonstatutory restrictions on the use of funds for technology or training purposes. This could be a particularly strong policy tool for leadership in areas likely to continue to receive substantial funding, such as the Title I program for disadvantaged students.

Research, development, and dissemination

Funders might be willing to make greater investments in educational technology and related professional development if there were better research suggesting the conditions under which such investments would be most effective, and if the results of available research were more widely distributed. Educational research and dissemination has traditionally been a federal role.

Congress could direct the Department of Education or some other entity to undertake research that examines the effectiveness of various technology tools and applications, including whether and how technologies work for teachers. Fertile areas of federal research could include investigations on whether using technology changes teaching and, if so, for which teachers and under what conditions; research on teachers as members of work groups and how the teacher's work life is changed by technologies; and alternate models of assigning teachers their time and duties when technology takes over some roles.

It is widely believed that educational applications of new technological developments often lag behind other applications. *Congress could direct federal executive branch agencies to increase their support for continuing research and development necessary for the production of powerful, flexible learn-*

TEACHING AND TECHNOLOGY: THE BARRIERS

Lack of teacher time to
- Experiment with new technologies
- Share experiences with other teachers
- Plan lessons using technology
- Attend technology courses or meetings

Access
- Hardware and software are limited
- Upgrades, support, and training are continuing costs
- Technologies may not be located in or near the classroom
- Much of the hardware in schools is old and cannot handle newer applications
- Telecommunications requires new or updated wiring or phone lines

Vision or rationale for technology use
- Schools and districts need technology planning and leadership
- Teachers need an understanding of curricular uses of technology
- Teachers lack models of technology for their professional use
- Messages on best uses change as technologies change

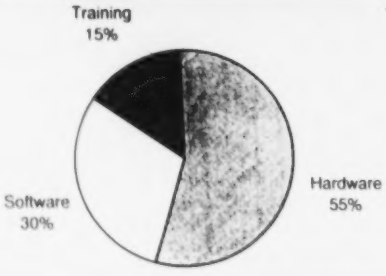
Training and support
- Districts spend far less on teacher training than on hardware and software
- Training focuses on the mechanics, not on integrating technology into the curriculum
- Few schools have a full-time, school-level computer coordinator

Current assessment practices
- Standardized tests may not reflect what students learn with technology
- Teachers are held immediately accountable for changes that take time to show results

SOURCE: Office of Technology Assessment, 1995

ing tools and applications. The development of the next generation of integrated curriculum products can work hand-in-hand with proposed educational standards in all curricular areas and could be undertaken as a national research priority. The federal government's seed money for product development can be said to have resulted in a sequential form of public-private partnership as technology products or projects have been developed, tested, and evaluated with federal support and later made commercially available.

DISTRICT COMPUTER BUDGETS: ESTIMATED ALLOCATIONS, 1992-93



Note: Technology coordinators estimated total computer budget amounts for the above three categories. N = 3,927.

Source: Market Data Retrieval, *Education and Technology, 1993: A Survey of the K-12 Market* (Shelton, CT: 1993).

Alternatively, the federal government could opt not to increase its role in education research and development, and encourage development of new education technologies by the private sector. If Congress or the executive branch took this approach, it would be worthwhile to study whether K-12 schools and colleges of education, with their persistent constraints on resources, represent enough of a market for educational technology product developers and how this market might be aggregated.

In education there is a large gap between research findings and their applications in day-to-day practice. *If it wants teachers to use technologies wisely, Congress could continue to encourage the use of technology—especially telecommunications networks—as a dissemination tool to share research results and get the results into the classroom where teachers can use them.*

Educating new teachers, professional development, and teacher support

The executive branch could encourage states, universities, and school districts to consider integrating technology into various professional development activities—inservice and preservice—supported under existing education legislation. Particular attention should be focused on the recently revised Eisenhower Professional Development Program (emphasized in P.L. 103-382), which calls for a larger federal teacher professional development effort in several subjects. The use of technology as a tool to provide more effective professional development could be given greater focus in all such programs.

Congress or the executive branch could require that all applications for federal grants that include technology show adequate bud-

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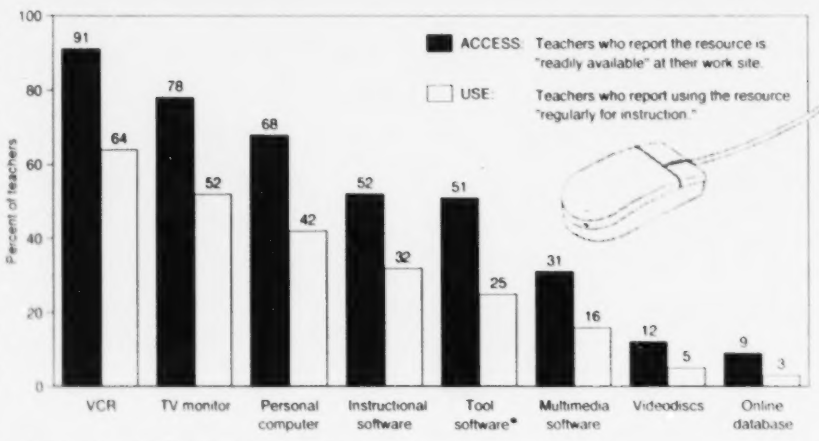
gets for preparation of staff and continuing support. This could help to assure that teachers will be given support over the long term, not just when the technology is brought in the door. Similarly, schools and districts could seek such support from the private sector.

The executive branch could on its own (or under Congress's direction) encourage and support technology applications when considering funding requests from schools and colleges of education. Schools and colleges of education should be encouraged to adopt teaching with technology so that new teachers learn by example.

TEACHERS REPORT ACCESS AND USE OF TECHNOLOGY RESOURCES, 1991



*For example, word processing, database management, spreadsheet.

SOURCE: National Education Association, Status of the American Public School Teacher, 1990-91 (Washington, DC: 1992).

School access to the emerging telecommunications infrastructure

The 104th Congress is again considering revisions to the Communications Act of 1934. If Congress wants schools and teachers to have access to the emerging national and global telecommunications infrastructures, it may need to consider carefully how different approaches will affect access by those in education.

It is becoming clear that access goes well beyond sheer numbers of machines and includes access to information available on those machines. Over the next decade, many individual, local, state, federal, and business decisions will determine whether this resource is broadly available or greatly restricted. Given the large federal role in interstate telecommunications issues, if schools are not to be left behind, Congress will need to pay close attention to this issue as it debates regulatory and subsidy measures.

It is important to note that none of the options for federal action discussed in this report necessarily requires a major new investment of federal funds or a major direct federal role. For example, none of them suggests that the federal government step in and install new technologies in all K-12 schools or colleges of education, or create a new bureaucracy for training teachers, or directly transfer resources from the telecommunications sector to educational institutions. The options presented here—federal, private, and local—are designed to support collaboration and voluntary efforts by those schools and districts that desire or require additional resources—and national encouragement—to take advantage of and experiment with new educational technologies that show promise for teachers and teaching.

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